K. K. Wagh Institute of Engineering Education & Research, Nashik

(An Autonomous Institute From A.Y. 2022-23)

WINTER-2025	
Exam Seat No.:	
Academic Year:2025-2026	Semester:V
Class:TY	Program:B.Tech
Branch Code:CHE	Pattern:2023
Name of Course:Process Equipment Design	Course Code:2307303
Max. Marks:60	Duration:2.30 Hrs.

Instructions: Candidates should read carefully the instructions printed on the Question Paper and on the cover page of the Answer Book, which is provided for their use.

1. This question paper contains 02 pages.
2. Answer to each new question is to be started on a new page.
3. Assume suitable data wherever required, but justify it.
4. Draw the neat labelled diagrams, wherever necessary.
5. The last columns indicates the Course Outcomes.

		Marks	CO
Question No. 1			
1a)	Illustrate and explain the roles of Liquid Distributors, Re-distributors, Hold-down Plates, and Packing Supports used in packed columns.	(6)	1, 2, 3, 4
Question No. 2			
2a)	Define a pressure vessel. Describe the various classifications of pressure vessels and provide suitable examples for each type.	(6)	1, 2, 3, 4
Question No. 3			
3a)	Design of skirt support for a cylindrical vertical vessel with the help of following data : Yield point : 250 N /mm^2 Permissible streeses of concrete : 40 N/mm^2 Permissible stresses: 140 N/mm^2 Diameter of the vessel: 3000 mm Height of the vessel: 37,500 mm Wind pressure: 1300 N/mm^2 Weight of the vessel with attachment: 1,90,000 kg Diameter if skirt: 3000 mm Height of skirt: 4800 mm	(8)	1, 2, 3, 4
	OR		
3b)	Enumerate and describe the essential components of pressure vessels, accompanied by suitable diagrams.	(8)	1, 2, 3, 4
3c)	Explain how volatile liquids are stored and outline the various losses associated with their storage.	(8)	1, 2, 3, 4
	OR		
3d)	A tall vertical vessel 1.5m in diameter and 12.8 m high is to be provided with the skirt support. Weight of the vessel with all its attachment is 80,000 kg. Diameter of the skirt is equal to the diameter of vessel. Height of the skirt is 2.3m. Wind pressure acting over the vessel is 100 kg/m^2. Seismic coefficient is 0.08m, permissible tensile stress of skirt material is 960 kg/m^2, permissible compressive strength is 1/3 rd yield stress of material. Yield stress is 24000 kg/cm^2. Estimate the thickness of skirt support.	(8)	1, 2, 3, 4

Question No. 4

4a)	Explain the different baffle types used in shell-and-tube heat exchangers and state their specific applications.	(8)	1, 2
	OR		
4b)	Describe a Calandria type evaporator with neat diagram. Illustrate its components and explain how heat transfer and circulation occur within the system.	(8)	1, 2
4c)	Discuss the criteria for allocating fluids to the tube side and shell side of a shell-and-tube heat exchanger.	(8)	1, 2
	OR		
4d)	A shell-and-tube heat exchanger is used for heating 10 kg/s of oil (C_p = 2.0 kJ/kg. K) from 25°C to 46° C. The heat exchanger has 1- shell pass and 6-tube passes. Water enters the shell side at 80°C and leaves at 60°C. The overall heat transfer coefficient is estimated to be 1000 W/m² K. Calculate the rate of heat transfer and the heat transfer area.	(8)	1, 2

Question No. 5

5a)	Explain the different mixing flow patterns observed in a reactor vessel (CSTR) with neat diagrams.	(8)	1, 2, 3, 4
	OR		
5b)	A flat-blade turbine agitator (6 blades) is used in a tank of 1.5 m diameter. Data provided: Agitator diameter = 0.5 m Speed = 200 rpm Specific gravity of liquid = 1.2 Viscosity of liquid = 600 cP Number of baffles = 4 Power Number (Np) = 4.5	(8)	1, 2, 3, 4
5c)	Explain the factors affecting the power requirement in an agitation system and discuss how power consumption is estimated.	(8)	1, 2, 3, 4
	OR		
5d)	Explain in detail the significance of the power curve in agitation and mixing processes.	(8)	1, 2, 3, 4

····· End of question paper·····